DOCUMENT RESUME

ED 232 599 HE 016 523

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TITLE The Integrator Role in Academic Computing AIR 1983 Annual Forum Paper.
PUB DATE May 83
NOTE 23p.; Paper presented at the Annual Forum of the Association for Institutional Research (23rd, Toronto, Ontario, May 23-26, 1983).
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Case Studies; Change Strategies; Computer Assisted Instruction; *Computer Oriented Programs; Consultants; Higher Education; Institutional Characteristics; *Linking Agents; *Organizational Change; *Program Implementation; *Technical Assistance
IDENTIFIERS Academic Computing; *AIR Forum

ABSTRACT

The role of integrators, individuals who facilitate communication and understanding, in facilitating the use of computer technology was explored, based on five case studies. It is suggested that a major obstacle to successful academic computing is getting faculty and students to use available computer resources effectively. In addition to helping people to overcome fear about using the computer and encouraging exploration of system capabilities, five technical integrator functions are identified: introductory training and periodic review of technical knowledge needed, technical consulting, technical interpretation, substantive consulting, and special ad hoc programming. Background information on the five case study institutions is presented. It is concluded that integrators help bridge the perceived gap between computers and users and that they bring divergent interests together for the benefit of the overall organization. Integrators also help the institution through the organizational change process that occurs with the implementation of academic computing. They help faculty members see the need for computing, make the transition to understanding and using computing, and institutionalize computing in their classes. (SW)

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THE INTEGRATOR ROLE IN ACADEMIC COMPUTING

Andrew T. Masland

When colleges and universities overcome the technical and financial problems associated with computer initiatives, they often find that people problems remain. The current literature on academic computing--the use of computer resources for instructional and research tasks--does not contain solutions to the people problems. This paper uses the concept of integrators, individuals who facilitate communication and understanding, to explore successful solutions to the people problems. Data from five case studies supports the hypothesis that the active presence of an integrator improves the likelihood of successful computing efforts.

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This paper was presented at the Twenty-Third Annual Forum of the Association for Institutional Research held at the Sheraton Centre in Toronto, Ontario, May 23-26, 1983. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC Collection of Forum papers.

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Several decades after the introduction of computing to the college campus, many schools have not integrated it into their academic programs. Colleges and universities often find that it is difficult to implement computer initiatives. Understanding computer technology, managing computer resources, and financing computers have been major difficulties in the past. Once technical and financial problems are resolved, however, inadequacies in collegiate computing often remain. People problems are a major stumbling block in computing efforts. This paper investigates the integrator role as one method of reducing the people problems that hinder academic computing efforts.

Colleges and universities use computers for a wide variety of tasks. This paper focuses on academic computing which comprises instructional and research computing. Among the many academic uses of computing are Computer Aided Instruction (CAI), Computer Managed Instruction (CMI), simulation and gaming, drill and practice, and so forth. The specific uses vary from list to list but include using the computer to support traditional instructional methods or using the computer to present and teach course material itself. Newer applications take advantage of the computer's abilities as information processor instead of a simple calculator. Thus academic computer use is expanding into a greater number of disciplines. Of course computers also play an integral role in programs in computer science where the computer becomes an object of study.

In 1967 a Presidential Science Advisory Committee stated ". . . students in colleges and universities must see for themselves what a powerful tool computing is, and learn to use it" (1967, p. 2). The

committee's report went on to say "computing is a versatile tool useful in any work with factual or intellectual content" (p. 7). Several years later predictions of revolutionary changes caused by technological advances emerged (Carnegie Commission, 1972; Levine, 1972). In the ten year period from 1967 to 1977 (the last year for which comprehensive data are available) the number of institutions with computers increased 115 percent, computer expenditures per student increased 238 percent, and the number of computer personnel on college campuses increased 106 percent (Alcorn, 1980).

Despite the rapid growth of computing, the early predictions of revolutionary changes have not materialized and commissions still make recommendations reminiscent of those made in 1967 (Gillespie with Dicaro, 1981). Statements in support of increased levels of computer "literacy" (sufficient knowledge to use and understand computers) still appear frequently (Masat, 1981; Luehrmann, 1980; Zinn, 1980; Molnar, 1979). Reports of colleges and universities taking major steps to improve computer literacy are considered newsworthy (Magarrell, 1982). Efforts to integrate computers into traditional academic curricula have met with only mixed success.

The literature on computing in higher education does not provide sufficient advice to ensure the success of academic computing. It deals with several broad subject areas. Among them are managerial issues such as personnel structure, resource allocation, and facilities planning (Mosmann, 1973; Robbins, Dorn, and Skelton, 1975). The literature also catalogs the wide variety of computer uses (Carnegie Commission, 1972; Levine, 1972). But it says little about how to increase the likelihood of successful implementation of academic computing. (For this paper,

success is defined as a general level of user satisfaction with current computer resources and a use of computing that is commensurate with institutional goals.)

A major obstacle to successful academic computing is getting faculty and students to use available computer resources effectively. Experts on computing in education note that people problems are a major part of the problem. Dr. Donald Blitzer, developer of the PLATO system, has said, "It is important that the teachers and students perceive that what they are doing is worthwhile" (1977). And Dr. Seymour Papert of MIT has said, "A lot of teachers are terrified about the computer and the reason they are terrified about the computer is that they see it as an alien and threatening thing" (1977). This paper focuses on one means of reducing the people problems associated with computing in higher education. The paper discusses an integrator role or the availability of someone who can facilitate the use of computer technology.

The Integrator Role

An integrator is an individual who facilitates communication and understanding in order to bring disparate parts of an organization closer together. Lawrence and Lorsch (1967) describe integrators in business organizations. As a business responds to environmental demands, individual departments adopt various operating strategies. Marketing and production, for example, may have different orientations towards goals, time, and interpersonal relationships. Each department's orientation develops because managers have only a limited span of surveillance and thus focus on their own needs and problems. Unfortunately, however, this differentation may be counterproductive to

the organization as a whole. Each department may lose sight of important organizational goals thus may work towards individual objectives which conflict with the overall mission. The integrator role emerges as a means of improving collaboration and coordination between departments. Integration requires facilitating communication and understanding between departments. Either an individual or a department can accomplish this goal.

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Welsch (1980) and Masland (1983) state that the integrator role is directly related to the successful implementation of Decision Support Systems (DSS). DDS are computerized systems that decision makers use to support nonroutine decisions. They go beyond the typical reporting characteristics of Management Information Systems because they can model or simulate decision situations. The presence of an integrator improves the likelihood of successful implementation of DDS? because the integrator facilitates the institutionalization and personalization of the DSS.

Welsch (1980) outlines facilitative and technical dimensions to the integrator role. There are two components of the facilitative dimension. First are missonary activities. The missionary helps users overcome fear and apprehensions about using the computer facilities. New users often exhibit hesitancy when they confront a computer terminal. The missionary leads the user by the hand, in effect, until he or she overcomes initial apprehensions. The second element of the facilitative role is a maturation-inducing function. In this role the integrator encourages the user to explore system capabilities. The integrator facilitates evolutionary growth in the use of computing. Once the user is comfortable with a system it is likely that he or she will want to

apply computing to new problems and issues. The integrator can help facilitate such a maturation of computer use.

There are five functions in the technical dimension of the integrator role. The first technical function is introductory training and periodic review of the technical knowledge needed to operate the computer system successfully. This orients the user to the system, its capabilities, and available application packages. The second technical function is technical consulting. Here the integrator offers advice on system operation, hardware and software, and how to solve technical problems. Because the integrator is familiar with the technical details of system operation, the user need not have a great degree of familiarity with such materials. The third technical function is technical interpretation. In this role the integrator translates technical language and jargon into terms the user understands. The integrator also helps translate the user's needs and requests into the appropriate language for the computer. Substantive consulting is the fourth technical role. In the case of DSS, the integrator may assist the user in the decision-making process. Fifth, the user may turn to the integrator for special ad hoc programming. In this situation the user does not have to know a high-level programming language.

The integrator role that Welsch describes may not exist exactly as she describes it. Each of the integrator functions Welsch describes may not be present, for example. An organization might stress facilitative functions over technical functions, introductory training over continuing training and review, or software consulting over hardware consulting. One individual or many could provide the integrator services. A department may have the integrator responsibilities or

individual experts may fulfill the roles. They could do this either officially as part of their job description or unofficially because of their knowledge and willingness to help other users.

While the details of Welsch's integrator differ from those of Lawrence and Lorsch, the major purpose is the same. In both situations the integrator role narrows the gap betwen two or more distinct groups. Just as integration improves collaboration between diverse departments, it lessens the distance between nontechnical computer users and sophisticated computer systems. Because integrators increase communication and understanding, it seems likely that a similar function would improve the likelihood of successful implementation of computer literacy programs in colleges and unviersities. This paper examines computing at five diverse institutions to determine if similar integrator roles are present in academic computing efforts.

Methodology

The case study approach is appropriate for this research because it permits exploration of the full range of possible integrator roles. Comparison with Welsch's description is then possible. The research sites are five colleges that differ on a number of dimensions including academic computer use. The colleges represent fairly typical computer installations and academic programs. Standish College (institutions are disguised to protect confidentiality) has several terminals and buys computer time from another institution. It offers few computer courses and does not have any full-time computer personnel. Quincy College supports academic computing via networking to access computers at other schools, slack resources on the administrative computing system, and a

small minicomputer. In addition to using computing in a wide range of courses, the college offers joint majors in computing and the liberal arts. One faculty member is part-time coordinator of academic computing. Concord College has a large minicomputer and a successful computer literacy program. Computer center personnel and faculty work closely together. Banks Business College requires computer courses of all its undergraduates and MBA students. It has two minicomputers and is a prime force behind the development of a local computer consortium. Trowbridge Technical Institute has a major computer center and other computer resources scattered across the campus. It uses computing in support of its engineering and technical majors.

Interviews with top administrators, computer personnel, and faculty computer users were the primary means of data collection. A semistructured format permitted exploration of the same central issues at each campus, while at the same time allowing respondents to raise computer-related issues that were important to them. The interviews probed the history of computing on the campus (when computing efforts began, who was involved, and the administration's and faculty members' role, typical academic uses of computing, the responsibilities of computer center personnel, and the general level of user satisfaction with current computer resources. Analysis of documents, such as college publications and reports, proposals, and the reports of external consultants provided additional information. Statistics on the historical use of computing also supplemented the interviews.

Findings

The five case studies demonstrate that the integrator role serves many of the same purposes for academic computing as it does for DSS. While many variables influence the success of academic computing, the presence and strength of the integrator role is associated with user satisfaction and the ease with which a college promotes academic computing. The brief descriptions of the research sites that follow illustrate the interplay between successful academic computing efforts and the integrator role.

Standish College has the least developed computer resources of the five case studies. It has very limited computer offerings and has not introduced computer science into its curriculum. Three terminals which access a computer at a nearby college are available for students and faculty. The primary users are the introductory programming and statistics courses. Standish College has no personnel exclusively for computing. The dean of the college, who readily admits to a limited knowledge of computers, is in charge of computing efforts. He relies on a mathematics instructor for advice. Users must turn to this same individual for answers to any questions they might have. There is no one on the campus who acts as an integrator. Faculty have little support for their efforts to become more familiar with computing. Little training occurs. There is no resource person on the campus who can answer questions and facilitate computer use. It is obvious that the lack of an integrator is not the only reason for the limited academic computing at Standish College. The institution has not committed many resources to computing and computer literacy is not a top priority. Thus Standish College illustrates an institution with limited

computing but it also demonstrates that the lack of an integrator may discourage expansion of academic computing.

Faculty at Quincy College are generally satisfied with the computer resources available to them. The college uses networking to access a variety of computer facilities, excess capacity of their administrative computing facilities, and a small minicomputer for the computer science program. While faculty may want additional computer power or specific application packages, sufficient computing is available to them. One faculty member, the coordinator (or) of academic computing, is responsible for the slowly increasing use of academic computing at Quincy College. The efforts to expand computing have been largely informal. As the coordinator introduced computing to his peers, they began to take advantage of the resource. He acted as a missionary when introducing computing and then went on, to a limited degree, to promote more advanced uses of computing. These efforts, however, were reactive for the most part. Other faculty have to search out the integrator and not vice versa. Thus at Quincy College one faculty member has provided the facilitative functions of the integrator role.

A small group of student computer assistants and the coordinator at Quincy have performed the technical integrator roles. The coordinator is responsible for advanced consulting and training. He is also the primary resource for software consulting. A faculty member who wants to use computing for a new task usually checks with the coordinator to find the best software, determine which of the colleges in the network has it, and learn the technical details of accessing the required computer. The student assistants are technical integrators. They are available to help their peers with computing. They answer questions about hardware

and the common software packages students use for class assignments. Introduction of the student assistants several years ago relieved the coordinator of some of these duties and increased the availability of an integrator to student users. Quincy College does not have a sophisticated computer literacy program, but it uses computing commensurate with its educational goals. The informal but explicit use of integrators facilitates the college's computing efforts.

While the integrator roles at Quincy College have been informal, Concord College has had formalized and explicit integrators. The college actively sought outside funding to support its early computing efforts. The proposals it wrote included provision for individuals in the computer center to fulfill the integrator roles, although they were not labeled as such. Computer center staff and about thirty student assistants help faculty and student users overcome the fear and apprehensions associated with new computer users. One staff member, the courseware specialist, is available to help faculty members discover new and more sophisticated computer applications for Concord College's liberal arts curriculum. The computer center staff are also technical integrators. They purposely keep technical jargon to a minimum and downplay all technical aspects of their computer. Their focus is on what the computer does for the user rather than how the computer does it.

Concord College also demonstrates that there are a variety of ways to provide the integrator functions. In addition to the staff members and student assistants, Concord College has achieved integration through several month-long seminars for faculty members. The explicit purpose of the seminars was to introduce faculty members to computers and computer

applications in their own discipline. The seminars thus got faculty to use a computer in a specific application for a course, provided consulting services for a month, and encouraged the faculty members to continue their use of computing. The faculty members who prticipated in the seminars have since encouraged their colleagues to use computers and so performed some of the integrator functions themselves.

Concord College has evaluated their computer literacy program. Among the factors that lead to the success of their computing efforts were the personnel responsible for introducing computing to the traditional liberal arts campus. While the internal reports do not specifically identify the integrator functions, it is clear that personnel at Concord College have fulfilled integrator roles. The college has developed sophisticated computer facilities and sought considerable outside funding, but the continued growth and acceptance of computing at the institution is related to the active effort made to reduce the distance between man and machine.

Computer Center staff at Banks Business College, on the other hand, have been reactive in their promotion of computer resources. The major impetus for computing at Banks has always come from faculty who view computing as a necessary skill and subject matter in today's corporate world. The computer center has provided the facilities faculty members need to meet these goals. In the past the director of academic computing tried to meet with faculty members each fall to determine their needs, but his stance was reactive. He responded to faculty suggestions instead of offering his advice and knowledge. The director and his staff did not attempt to encourage new uses of academic computing.

On the technical side, the computer center staff did provide assistance to users with questions or problems. They offered a few introductory training seminars but these were never well attended. They usually did not attempt to translate technical jargon and, in fact, were more oriented toward the machine than the user. Student assistants were the primary resource for students with questions about the computer or their assignments. The computer center staff also expected individual faculty members to be the primary specialist for the software packages they use. The director of computing felt it was not apppropriate, nor did he have the funding or the staff, to provid consulting on the many different academic software packages faculty at Banks use.

All of the business majors at Banks make use of the computer. The college recently discovered, however, that while the absolute level of computer use has increased over time, fewer and fewer courses use computing. Students do more computing, but in fewer classes. There also is only limited computer use in the nonbusiness disciplines. The lack of integrators illustrates that the computer center has not provided active support for computing at Banks. While technical assistance and answers are available, individual users must seek them out. The computer center staff performs some of the integrator functions but only upon request. Thus Banks demonstrates that integrators encourage computing only if they are visible and accessible to computer users.

Trowbridge Technical Institute is the final case study. It is a different kind of institution than the other four because its primary mission is technical and engineering education. A number of computer resources including a mainframe computer, several minicomputers, and a

large number of microcomputers are available to faculty and students. Computer resources have proliferated across the campus and the administration has made only a limited effort to control such proliferation.

The director of computing at Trowbridge has always felt that he did not need to provide extensive user support because most users at the college are technically sophisticated. They are familiar with computers and their uses. The primary area for consulting is in the technical areas and a little for application packages. But like the director at Banks, Trowbridge's director feels that it is the user's responsibility to know the software. The computer center does not provide extensive assistance for student users either.

Trowbridge Tech is successful with their academic computing. The college provides computing services that match its educational mission. There is less computing in the nontechnical majors, however, than at comparable liberal arts colleges. Even faculty from technical majors feel that the computer center should provide greater user assistance than it does. Thus Trowbridge is a college that has a successful academic computing program even though it does not have anyone fulfilling the integrator role. Yet there is evidence that if an integrator were present, users might be more satisfied.

Integrators for Academic Computing

The five cases demonstrate the variety of integrator functions for academic computing. Many of these functions are those Welsch (1980) and Masland (1983) found in successful DSS implementations. But there are some minor variations and changes. At this point it is helpful to

review the integrator roles to note similarities and differences between DSS integrators and academic computing integrators.

The missionary role is the first facilitative function. Quincy and Concord Colleges clearly demonstrate the missionary role. There are individuals on each campus who provide psychological support for new users. They help users overcome the fears and apprehensions commonly associated with new computer users. Welsch's use of the term "missionary" seems especially appropriate because the integrator often "converts" new users. Many faculty members and students explicitly change their beliefs about the value of computing in higher education once they learn its value to them. Concord College also illustrates how an institution can undertake missionary activities on a large scale through an effective computer literacy program that includes faculty seminars.

The maturation-inducing role is the second facilitative function. Academic computing benefits if this service is available on the campus. Faculty who receive assistance in exploring computer use continue to apply computing to new tasks. A school like Banks Business College, that relied on faculty initiatives to expand computer users, found that actual penetration of computing into the curriculum declined. Faculty members who were not familiar with computing had no easy means of learning about the resource. Faculty at Concord College, on the other hand, knew that there was a specific individual in the computer center to help them explore and evaluate new applications for computing in their work.

While the major technical functions of the integrator that Welsch describes are apparent in academic computing there are some minor

variations. The introductory training role is a central part of the technical functions. Individual faculty members are often responsible for introducing their students to computer resources. But three of the five research sites also provide other introductory formats. In addition, periodic seminars are often offered to users who want to learn more about computing in general or about specific application packages.

Technical consulting is available but is of less importance than some of the other integrator functions. Three of the five schools de-emphasize the technical aspects of computing. For this reason it is useful to break Welsch's technical consulting role into two roles for academic computing. The first is the technical consultant who deals with hardware and the operations of the computer equipment. The second is a software consultant who advises users on application packages. This role is more important on the college campus because most users are interested in what the computer does for them, not how the computer functions.

Another important technical role is acting as a technical interpreter. The traditional use of jargon has distanced computers from their users. This distance still intimidates many faculty members and students. Translating the language of computing for users makes the resource more understandable and easier to approach. Users often gain confidence just knowing they can turn to someone who can help them understand technical manuals and instructions. The integrator can also help translate in the opposite direction; helping the user frame his questions and problems in proper technical terms.

The last two technical functions that Welsch describes, the integrator as substantive consultant and ad hoc programmer, do not

appear in the case studies. It seems likely that the diverse subject matters of academic disciplines are simply too wide for an integrator to be an effective substantive consultant. It is possible that there are other integrators on the campus who might fulfill this function. A more experienced user in a faculty member's own department, for example, might act as an informal substantive consultant. Ad hoc programming may not appear because faculty tend to use either software packages such as SPSS that do not require ad hoc programming or they are sophisticated enough to do their own programming.

At this point it is also important to stress that the integrator role can be present to varying degrees. It may be explicit or implicit. All six integrator functions or a subset of them may be present on a campus. Which integrator functions are available depends on the needs of the users and the goals of the campus' academic computing program. One individual may fulfill the integrator role or several may do so. And the need for the six functions may change over time as users' needs and sophistication change. Thus the integrator role is not a solid monolith. It is a collection of functions that help campuses utilize available computer resources.

Implications

The case studies this paper cites illustrate how integrators function in academic computing and who might fill such roles. The integrators help bridge the perceived gap between computers and their users. They reduce the many differences between the groups. Thus such integrators follow in the tradition of Lawrence and Lorsch's integrator. They bring divergent interests together for the benefit of the entire

organization. When computing becomes easier to understand and seems less foreign, faculty and students should take better advantage of it, as many experts hope they will.

The integrators also help the institution through the organizational change process. The implementation of academic computing requires substantial changes on the part of many faculty members. The integrator helps faculty members see the need for computing, make the transition to understanding and using computing, and institutionalize computing in their classes. Integrators assist users through these steps and improve the likelihood that faculty members complete the process. Gillespie and Dicaro (1981) state that many faculty members are unsure of how to take advantage of changing computer technology. They feel this is a stumbling block in efforts to integrate computing into higher education. An integrator assists faculty members through this important process.

This paper reports on a preliminary investigation of the integrator role in academic computing. A more extensive and formalized evaluation of the role would pinpoint how extensive the use of integrators is in higher education, if integrators are responsible for the success of computing efforts, if the usefulness of integrators continues over time as users become more sophisticated, and whether or not institutions have explicitly formulated the integrator role when planning academic computing programs. But it is clear nontheless that the role does exist and can be useful.

The presence of an integrator does not solve all of the problems associated with academic computing. Users must have ready access to computer resources to meet their needs. The college or university must

have sufficient funds to finance the necessary computer equipment. There must be knowledgeable personnel to manage the computer facilities. But as the past several decades demonstrate, ample computer resources alone do not guarantee successful academic computing. Computer resources are a worthwhile investment if they are used effectively. An integrator helps ensure effective use and thus is an important part of academic computing efforts.

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